

2-2.5 Layouts, Profiles, and Superelevation Diagrams

General

A layout sheet is defined as one of the following:

- Full Plan Sheet
- Combined Plan and Profile Sheet
- Combined Plan, Profile and Superelevation Diagram Sheet

The layout is the base plan sheet for the project. Other plan sheets such as drainage, utilities, signing and pavement delineation etc., are necessary when there is not sufficient space to clearly show all work on the layouts.

Layouts shall contain general project data such as the proposed construction, existing facilities, horizontal alignment lines, right of way lines and easements.

At interchange areas it may be necessary to show plan and profile on separate sheets. In metropolitan areas and at rural interchanges, separate full layout plan sheets may be necessary to show all the required data. Where a full plan sheet is needed for plan layout, full profile sheets shall be used to show main line profiles and profiles of supplemental lines.

Where main line profiles appear on combined plan and profile layout sheets, full profile sheets shall be used to show the profiles of supplemental lines, such as frontage roads, crossroads, ramps, ditches, channel changes and other roads which cannot be added conveniently to the profile portion of the combined plan and profile layout sheet.

For layout sheets, a horizontal scale of 1" = 50' (base scale) should be used in urban areas and some rural areas. A horizontal scale of 1" = 100'

may be used in rural areas. It is permissible to use both scales within a set of plans provided each sheet contains only one scale. Where a horizontal scale of 1" = 50' is used and just a few items of work are involved, the roadway layout information may be stacked one above the other on the same plan sheet. A horizontal scale of 1" = 20' is used where greater detail and clarity is required. These sheets would typically be used for road intersections, signal and lighting plans, etc.

Layout sheets shall be oriented to show mainline stationing progressing left to right with the exceptions contained within this section. All station lines and profiles shall be shown in feet only.

If arrangement of the roadway layout information is such that "stacking" is necessary (the roadway layout information stacked one above the other on the same plan sheet), the sheet shall be arranged so that the stationing progresses from the top half of the sheet to the bottom half of the sheet using match lines.

Sheets shall be arranged to contain major construction features on one sheet. Wherever possible, the major portion of an interchange should appear on one sheet. This may necessitate breaks and match lines for the ends of minor road connections. Station equations may cause the profiles, if shown at the bottom of the layout plan, to determine sheet arrangement. Where feasible, ramp and auxiliary road profiles should be complete on one sheet. Sheets should not end within a road intersection. The complete road intersection should be shown on one sheet. Diagonal placement is satisfactory to attain better coverage. Mainline stationing shall not overlap from one sheet to the other. Match lines shall be shown. Match lines should occur halfway between station tick marks and be perpendicular to the main route station line. If a match line occurs on a station tick mark, the stationing

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should be identified with the match line callout. References to adjoining sheets at the match lines, such as "See Sheet L-5" or identifying the stationing at the match line, are optional, but may be advisable where many match lines are shown on a sheet (such as sheets showing interchange areas, freeway to freeway connectors, etc.)

As a general rule, if a project contains only one crossroad or crossing route where construction is to be performed, the sheet numbering order of the mainline is interrupted to show the entirety of the construction on the crossroad or crossing route. The sheet numbering for the crossroad or crossing route shall begin with the next consecutive sheet number after the interrupted mainline sheet number (example: mainline, L-4; beginning sheet for crossroad or crossing route, L-5). Sheet numbers shall be sequential. If the last sheet number used for the crossroad or crossing route is L-8, the mainline sheet numbering will resume with L-9. The sheet(s) containing the crossroad or crossing route information may be rotated to attain better coverage. Stationing shall in most instances progress from left to right on a sheet, but in some instances stationing may progress from the bottom to the top of a sheet. If a project contains more than one crossroad or crossing route, first complete the mainline presentation, then put the crossroad or crossing route sheets at the end of the layout sheet order.

Preparation Procedures

CADD permits the separation of drawing data by kind of data. The CADD system defines the various layers of similar data as "levels." Geographical drawings are created by combining levels of data from a master drawing. Refer to Section 2.4 of the CADD Manual.

Existing topography may be provided by scanned maps, digitized maps, or maps from ground surveys. Photogrammetric mapping

lines and symbols are shown on Standard Plan A10D. Symbolology for construction features is shown on Standard Plan A10C.

Existing facilities shall be shown in dashed lines or dropped out and proposed construction in solid lines.

Caltrans symbols, abbreviations, and line symbolology shown in the Standard Plans, the Caltrans CADD English Cell Library, and the Caltrans Line Style Resource file shall be used. Abbreviations and symbols not listed in the Standard Plans, which are used within the layouts, shall be listed along with their meanings on the first layout sheet. Do not duplicate acronyms or abbreviations shown in the Standard Plans.

Line weights and line styles shall conform to the requirements in Section 2.7 of the CADD Manual. Refer to Section 2.6 of the CADD Users Manual for text sizes and fonts. Caltrans preference is the use of uppercase text, because it is easier to distinguish characters within the message. See Section 2-1.2 of this manual regarding placement of text.

Plan Content

On extensive or complex projects, there may be too much information to show clearly on the layouts. Design information should be grouped by type and shown on separate plans such as: drainage, utilities, pavement delineation, etc. The proposed design information shall only be shown on one type of plan sheet. Some proposed design information may be shown as existing due to stage construction or sequence of work (example: Stage 1 construction should be shown as existing on plan sheets for Stage 2 work since the work from the prior stage or sequence will have been completed).

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Only those existing topographic features which affect bidding, construction, and maintenance, and which are essential for field orientation of the plans shall be shown. Showing too much extraneous topographic information makes it difficult to clearly see the important design information on the layout. Confine topography to the right of way or area of construction, including the space needed for equipment. In urban areas any features pertinent to construction, such as streets, curbs, gutters, and sidewalks involved in the construction, should be shown. In rural areas where little topography exists, all topography may be shown if it does not clutter the layout. Buildings and facilities within the right of way that will be removed prior to construction are not to be shown.

Routes or roads not part of the project construction, but shown on the plans for orientation purposes, should be identified and labeled with normal size text. Routes or roads where project construction is to be performed may be identified with larger size font to make them stand out on layouts which contain a large amount of information.

Solid lines are to be used for proposed construction items. Indicate what work is to be performed on existing facilities, such as "abandon" or "remove." Do not use the words "construct," "place," etc., for new construction, as they do not convey additional information to the contractor. Necessary dimensions are to be included, and distances should be shown using plus stations at the begin and end of roadway items shown on the layouts.

If subsurface facilities (including State-owned underground utilities and underground utilities owned by others) are within the areas where project work is to be performed and there is possible conflicts with these facilities, then the facilities must be shown on the project plans. If they are not shown on the project layout sheets or the plan sheets related to that specific

type of work, then they must be shown on the project utility plan sheets.

Accuracy of the locations of State-owned underground utilities should not hinder disclosure of underground facility information. The location of these facilities are to be shown to the best degree of information available.

Unless specifically exempted, all utility facilities known to the designer shall be shown on the project plans.

High risk and low risk underground facilities shall be shown as provided in Appendix LL, "Utilities," of the Project Development Procedures Manual (PDPM).

Alignment data for all stationing lines (mainlines, ramps, crossroads, frontage roads, relocated local streets, etc.) shall be shown. Stationing equations, distances and bearings of all tangents, stations of all curve points and curve data shall be shown.

All curve data numbers shall be consecutive for each station line. Do not start curve data numbers over when going to the next layout sheet. Curve data numbers for different station lines may have gaps in the numbering from other station lines, thus allowing for possible last minute changes without having to renumber curve data from any other station line than the one changed. Do not duplicate curve numbers on a project.

Project control and monumentation points shown on the Project Control sheet may also be shown on the layouts for convenience. If coordinate information is included on the layouts, place a note on the first sheet of the layouts with a reference to the Project Control sheet for the basis of the horizontal control used.

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Coordinate values may be included on the layouts within the curve data tables for selected points (BC's, EC's, POC's) along the stationing line. The addition of coordinate information should only be for convenience of orientation and shall not take the place of supplying the required electronic files to surveys and construction containing station lines, staking, and surveying information needed for construction.

Show and label right of way lines, easement lines and right of entry. Show and label township and section lines and corners, recorded subdivisions, Spanish grants, swampland and tideland surveys, and state, county, and city lines.

The "Checklist for Layouts" contained elsewhere in this section lists the various elements included on the layout sheet.

Profile Content

Data shown on the full profile sheet or the lower half of the combined plan and profile sheet can usually be produced from the roadway software. The most common vertical scales are:

- 1" = 10' - Rural sections in hilly and mountainous terrain with considerable rise and fall.
- 1" = 5' - Rural or urban areas with gently rolling terrain with less than two percent general ground slope.
- 1" = 2' - Rural or urban areas in level terrain where precise grade and gutter design is required.

Horizontal to vertical scale ratios producing profile grade line plots steeper than 1:1 should be avoided, scale ratio of H/V = 10 is most commonly used.

The datum elevations should be placed on top of the horizontal grid line they represent at both ends of the profile line. Placing datum elevations on all grid lines on the sheet is not necessary. Only a few elevations slightly above and below the profile line are needed.

The basis of the vertical control is to be shown by a note on the first sheet of profiles.

The original groundline must be checked for obvious errors in plotting and missing break points at ditches, levees, etc.

The original groundline and profile grade line should not crowd the top or bottom of the sheet.

On combined plan and profile sheets the profile stationing shall line up with the stationing as shown in the plan portion.

On full profile sheets the horizontal scale need not correspond to the plan scale on the layouts but it is recommended.

Where profiles are "stacked" on full profile sheets, they shall be arranged so that stationing progresses from the top half of the sheet to the bottom half of the sheet.

Profile stationing shall not overlap. Equation stations may control coverage and arrangement. A gap in the profile line should be shown between the back and forward stations of the equation. The preferred method of showing the gap is to stop the profile line at the back station of the equation on the profile sheet and resume showing the profile line at the forward station of the equation on the next profile sheet, unless impractical to do so. Where the equation station gap is shown on the same profile sheet:

- The beginning of the gap shall be at the back station of the equation and the end of the gap shall be at the forward station of the equation.

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- The actual distance through the equation between adjacent full stations is to be shown.

To provide a complete picture, the original groundline is to extend a few stations beyond the beginning and end of the project if this does not require an additional sheet. Future grade lines (usually prompted by the staging of construction contracts) are to be labeled and shown as short dashed lines. Other grade lines, such as ditches, gutters, and pipes, are to be shown by symbology as depicted in the Standard Plans and so labeled.

If the profile grade line is not on the station line, or the construction layout line for a wall, a note is to be added to indicate the position of the profile grade, such as "Profile Grade at Inner ETW" or for example "Profile Grade is 3' Left or Right of station line."

The names of all major intersected streets, railroads, grade separation structures, streams, and other station lines are to be labeled vertically (bottom to top) along the profile.

Roadway excavation and embankment quantities should be listed along the bottom of the profile (on both full profile sheets and plan and profile sheets). These quantities may be listed by station, or individual cuts and fills (division points of cut and fill quantities may not be at same station limits). One of the reasons for listing excavation and embankment quantities is to help bidders and the contractor determine haul distances and understand the scope of the earthwork. Where the roadway crosses a stream or crossroad, the point of crossing should be a division point for listing cut and fill quantities. Where quantities for major ramps or other roads have been calculated separately, they are to be listed with their respective profiles rather than lumping them with the main line. In such a case, a cross-reference note is desirable. Sheet totals should be shown in the lower right corner when

quantities are listed by station. Where an individual cut or fill area carries over to the next sheet, the total for the individual cut or fill is to be carried over and shown on the next sheet.

The "Checklist for Profile" contained elsewhere in this section lists the various elements included on the profile sheet.

Superelevation Diagram

A superelevation diagram is a graphic representation of the crown slopes, superelevations, and superelevation transitions of the pavement and shoulders.

Vertical curves at the beginning and end of superelevation transitions do not need to be shown.

Certain combinations of profile grade line, vertical curves, superelevation transitions, and variable pavement widths may produce undesirable pavement edge profiles. Where these combinations occur, it is essential to generate edge of pavement and edge of shoulder profiles and adjust bumps and drainage pockets to eliminate ponding. These edge of pavement and edge of shoulder profiles should be drawn to an exaggerated vertical scale and submitted to the Resident Engineer for use in staking.

The "Checklist for Superelevation Diagram" contained in this section lists the various elements included on the superelevation diagram sheet.

CHECKLIST FOR LAYOUT SHEET (Page 1 of 2)

- | | |
|---|---|
| <p><input type="checkbox"/> District, county and route TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</p> <p><input type="checkbox"/> Post Miles TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</p> <p><input type="checkbox"/> CU No. and EA No. (lower right corner of sheet) TX=7.0, FT=3, WT=1, LV=10</p> <p><input type="checkbox"/> Signature only included on Level 63. Date of signature and current registration seal information included on Level 10, (lower right corner of sheet). Drafting reviewers will attach signatures when project goes to PS&E. Text height should be 7, but the width can be squeezed to fit the area using element selection. If both names are long, the first name can be above the last name. FT=3, WT=1</p> <p><input type="checkbox"/> Standard north arrow (AC = NARR)</p> <p><input type="checkbox"/> Scale (TX=8.75, FT=3, WT=2, LV=10)</p> <p><input type="checkbox"/> Information inserted in plan sheet development name block spaces in left margin of sheet. See Figures 2-10 and 2-11 in Section 2-1.6 of this manual for additional instructions.</p> <p><input type="checkbox"/> The following note shall be shown on each layout sheet: "For complete right of way and accurate access data, see right of way record maps at district office." In the case of a conventional highway, omit the words "and accurate access." Include this note on any other plan view sheet that shows right of way lines.</p> | <p><input type="checkbox"/> First sheet of layouts contains notes, legends, symbols, and a list of abbreviations (do not include standard plan abbreviations as part of the listed abbreviations)</p> <p><input type="checkbox"/> Line designations (typically placed above alignment line and preceding bearing and distance)</p> <p><input type="checkbox"/> Bearing and distance of tangent sections on all stationed lines (typically placed above alignment line) - (showing coordinate information for selected points is optional)</p> <p><input type="checkbox"/> Station equations</p> <p><input type="checkbox"/> Identify routes within the project limits. Do not use route shields. The following typically applies to route identification where work is performed: TX=8.75, FT=3, WT=2, LV=60 – On routes where no work is being performed, the following may apply: TX=7, FT=3, WT=1, LV=60 – On very complex projects, where the layouts contain a large amount of information, the following may apply to identify routes where work is performed: TX=10, FT=43, WT=0, LV=60</p> <p><input type="checkbox"/> Curve data (all curve data numbers shall be consecutive "for each station line" throughout the layout sheets)</p> <p><input type="checkbox"/> Edge of traveled way and shoulders</p> <p><input type="checkbox"/> R/W lines and access control lines (access control tick marks are not required on project plans)</p> <p><input type="checkbox"/> Fences and gates</p> |
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CHECKLIST FOR LAYOUT SHEET

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| <input type="checkbox"/> Township, range and section lines (not necessary to show within city limits) | <input type="checkbox"/> Detours, stage construction, or traffic handling (unless shown on separate sheets) |
| <input type="checkbox"/> City, county limits and names | <input type="checkbox"/> Pavement removal |
| <input type="checkbox"/> Guard railing, barriers and crash cushions | <input type="checkbox"/> Existing pavements |
| <input type="checkbox"/> Drainage, striping, signing, and utilities (unless shown on separate sheets) | <input type="checkbox"/> Curbs and dikes |
| <input type="checkbox"/> Label utilities as to type, size and ownership (unless shown on separate sheets) | <input type="checkbox"/> Sidewalks, driveways, curb ramps (type) |
| <input type="checkbox"/> Bridge names and numbers (show bridge number only when work is to be performed on bridge and bridge plans are included) | <input type="checkbox"/> Grinding, cold planing, and replace asphalt concrete surfacing, etc |
| <input type="checkbox"/> Waterways (stream, creek, river, etc.) and direction of flow | <input type="checkbox"/> Survey monuments (to be set) |
| <input type="checkbox"/> Retaining walls and sound walls shown and labeled on layouts for length, layout line, and distance from ETW only | <input type="checkbox"/> Topography (when pertinent) |
| <input type="checkbox"/> Mandatory material and disposal sites (use of mandatory sites is to be avoided where possible). If the sites are not within project limits, include in Materials Handout and not on the layouts | <input type="checkbox"/> Cut and fill lines |
| <input type="checkbox"/> Road approaches | <input type="checkbox"/> Easement and permits |
| | <input type="checkbox"/> Edge drain locations, including types of outlets, vents and cleanouts. If layouts are cluttered edge drains can be shown on drainage plans. If drainage plans are also cluttered, edge drains can be shown on separate edge drain plans. |

CHECKLIST FOR PROFILE

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| <input type="checkbox"/> Profile lines with designation and grade percent | <input type="checkbox"/> Road and driveway approach grade lines with line designation and grade in percent |
| <input type="checkbox"/> Original ground lines with label. Original ground line should extend a few stations beyond the beginning and end of profiles on the first and last sheet | <input type="checkbox"/> Datum at both edges of sheet (on top of the horizontal grid line) |
| <input type="checkbox"/> Future grade lines (used for staged contracts) shown as short dashed lines and labeled | <input type="checkbox"/> Plus station for points where elevations shown do not fall on vertical grid lines |
| <input type="checkbox"/> Vertical curve lengths and tangent gradients, gradients must be shown at points of reverse or compound curvature | <input type="checkbox"/> Station equations |
| <input type="checkbox"/> Elevations (shown at BVCs, EVCs, PRVCs, and PCVCs, equations, paving notches, broken profiles for datum changes, and at each edge of sheet on profile grade), no additional elevations need be shown on vertical curves | <input type="checkbox"/> Benchmarks (showing elevations is optional) |
| <input type="checkbox"/> Top rail elevation (railroad) | <input type="checkbox"/> Superelevation diagram where sufficient space is available on profile sheet (show superelevation diagram directly above the corresponding profile, so that the stationing matches). For specific superelevation diagram elements to be shown, see “Checklist for Superelevation Diagram.” |
| <input type="checkbox"/> Station and elevation of begin and end bridge | <i>Where the profiles or both profiles and superelevation diagrams are shown on their own separate sheets, include this</i> |
| <input type="checkbox"/> Earthwork quantities (listed by station, or individual cuts and fills) – sheet total | <input type="checkbox"/> District, county and route TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet) |
| <input type="checkbox"/> Label bridge name and number (show bridge number only when work is to be performed on bridge and bridge plans are included) | <input type="checkbox"/> Post Miles TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet) |
| <input type="checkbox"/> Street or road station line or centerline and identify where it crosses main profile line | <input type="checkbox"/> CU No. and EA No. (lower right corner of sheet) TX=7.0, FT=3, WT=1, LV=10 |

CHECKLIST FOR PROFILE

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- ☐ Signature only included on Level 63. Date of signature and current registration seal information included on Level 10, (lower right corner of sheet). Drafting reviewers will attach signatures when project goes to PS&E. Text height should be 7, but the width can be squeezed to fit the area using element selection. If both names are long, the first name can be above the last name. FT=3, WT=1
- ☐ Information inserted in plan sheet development name block spaces in left margin of sheet. See Figures 2-10 and 2-11 in Section 2-1.6 of this manual for additional instructions.
- ☐ Scale – vertical and horizontal (TX=8.75, FT=3, WT=2, LV=10)

CHECKLIST FOR SUPERELEVATION DIAGRAM

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Where the superelevation diagrams are shown on their own separate sheets, include this information on those sheets:

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| <input type="checkbox"/> Axis of rotation line (0%) | |
| <input type="checkbox"/> Each pavement and shoulder plane shown and labeled | <input type="checkbox"/> District, county and route TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet) |
| <input type="checkbox"/> Stationing below diagram | <input type="checkbox"/> Post Miles TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet) |
| <input type="checkbox"/> Station pluses of PIs that do not fall on a vertical grid line | <input type="checkbox"/> CU No. and EA No. (lower right corner of sheet) TX=7.0, FT=3, WT=1, LV=10 |
| <input type="checkbox"/> Location of horizontal BCs and ECs indicated with vertical lines, (show stations, radii, and direction of curvature where the superelevation diagram is not shown on combined plan and profile sheet) | <input type="checkbox"/> Signature only included on Level 63. Date of signature and current registration seal information included on Level 10, (lower right corner of sheet). Drafting reviewers will attach signatures when project goes to PS&E. Text height should be 7, but the width can be squeezed to fit the area using element selection. If both names are long, the first name can be above the last name. FT=3, WT=1 |
| <input type="checkbox"/> Percent at both edges of sheet (on top of the horizontal grid line) | |
| <input type="checkbox"/> Station equations | <input type="checkbox"/> Information inserted in plan sheet development name block spaces in left margin of sheet. See Figures 2-10 and 2-11 in Section 2-1.6 of this manual for additional instructions. |
| | <input type="checkbox"/> Scale – horizontal |